MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

EEL4106 – HIGH VOLTAGE ENGINEERING

(LE)

2 MARCH 2017
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages including the cover page with 4 Questions only.

2. Answer **ALL** questions. The distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) The circuit is shown in Fig. Q1.

i. Name the type of circuit shown in Fig. 1. [2 Mark]

ii. If the output voltage produced in A is 2 V, what is the output voltage produced in B? [2 Marks]

iii. With proper labelling, draw the circuit to obtain 8 V. [5 Marks]

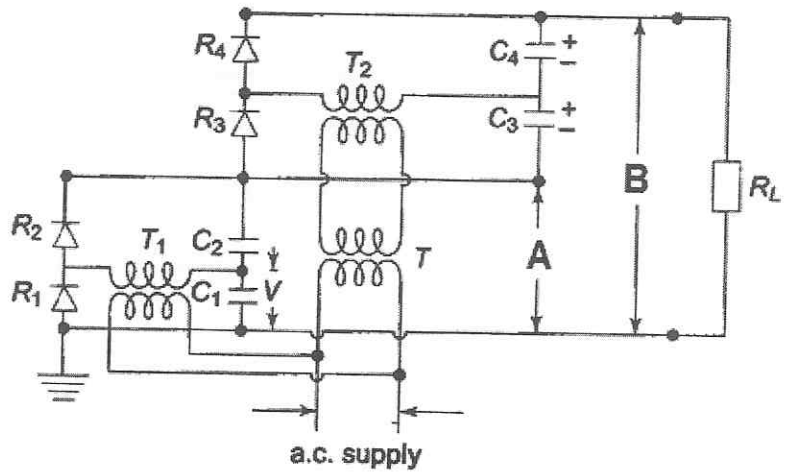

Fig. Q1

(b) A typical electrostatic generator has the belt width of 0.8 m and the velocity of belt of 15 m/s. Calculate the current supplied by generator. Assume E is 30 kV/cm and ε_o is 8.854 pF/m. [4 Marks]

(c) Briefly explain **TWO** advantages of resonant transformer [3 Marks]

(d) A 200-kVA 350-V/300-kV feed transformer has resistance and reactance of 2% and 4%, respectively. This transformer is used to test a cable at 400 kV at 60 Hz. The cable takes a charging current of 1 A at 500 kV.

i. Determine the series inductance required. [5 Marks]

ii. Assume 2% resistance of the inductor. Determine the input voltage to the transformer. Neglect dielectric loss of the cable. [4 Marks]

Continued...

Question 2

(a) Briefly discuss **TWO** advantages and **TWO** disadvantages of uniform field spark gap used for high voltage measurements. Given that the air gap is of 2 mm length, determine the breakdown voltage under uniform field with standard atmospheric conditions. [4+4 Marks]

(b) Draw a typical circuit of Chub and Fortescue measurement method. Briefly describe the limitations of Chubb and Fortescue method, and adjustment that needs to be made on the circuit. [4+3+2 Marks]

(c) A generating voltmeter is to read 100 kV with an indicating meter having a range of (0 – 20) μA calibrated accordingly. Calculate the capacitance of the generating voltmeter when the driving motor rotates at constant speed of 1000 rpm. [5 Marks]

(d) List out **THREE** types of short circuit tests that should be conducted on circuit breakers. [3 Marks]

Question 3

(a) List out **FIVE** effects of corona. [5 Marks]

(b) List out **FOUR** important properties of dielectric liquid and briefly describe two reasons why liquid dielectrics are preferable as compared to gaseous dielectrics. [4+4 Marks]

(c) Fig. Q3 shows the void in the solid dielectric material, where t is the depth of the cavity, and d is the thickness of the solid dielectric material. Draw the equivalent circuit of a dielectric material with a cavity to represent the void in the solid dielectric material. [3 Marks]

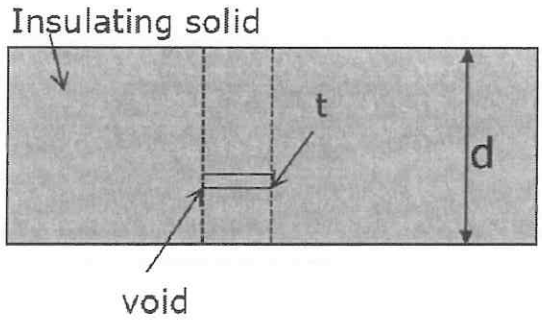

Fig. Q3

Continued...

(d) Table Q3 shows the measurements obtained while studying the Townsend phenomenon in a gas under a uniform electric field. Calculate the values of the Townsend's first and second ionization coefficient.

Table Q3

d, mm	0.3	1.0	1.5	1.8	2	3.5	4	6	8	9.5	10	18
I, pA	0.6	0.7	0.8	0.9	1.25	1.7	2.3	3.1	5.8	10	20	400

[9 Marks]

Question 4

(a) List out **FIVE** causes of the switching overvoltage occurring in the power systems. [5 Marks]

(b) Define the following types of insulation:

i. External insulation
ii. Internal insulation
iii. Self-restoring insulation
iv. Non-self-restoring insulation

[8 Marks]

(c) List out **ONE** advantage and **ONE** disadvantage of the rod gap (horn gap). [4 Marks]

(d) One of the basic philosophies to provide protection against overvoltage is to reduce the frequency of occurrence of high voltage surges to the extent possible by providing ground wires and lightning masts with a large number of ground wires. Briefly describe another **TWO** basic philosophies. [4 Marks]

(e) A 550 kV, 1 μs rectangular surge on a line having surge impedance of 300 Ω approaches the terminal ending with a concentrated earth capacitance of 2000 pF. Determine the maximum value of the transmitted wave. [4 Marks]

End of Paper.